ER 58 – Electrician Regulations Answer Schedule

Notes: 1. (1 mark) means that the preceding statement/answer earns 1 mark.

2. This schedule sets out the expected answers to the examination questions. The marker can exercise their discretion and decide on the overall accuracy of any answer that is presented in the candidate’s own words.

3. Symbols and terms - alternatives

Power	W or P
Voltage	V or E or U
Phase	Active

Question 1	*Marks*	*Reference*	*Marking notes*
(a) Where the connection to the supply is solely for the purpose of carrying out testing, inspection or certification required by the regulations.	(2 marks)	EA 82(4)	
(b) Any TWO of: ● Persons who apply for practising licences or provisional licences. ● Persons who hold practising licences or provisional licences. ● Persons who apply for renewals of practising licences or provisional licences.	(2 marks)	 EA 108(1)(a) EA 108(1)(b) EA 108(1)(c)	
(c) They must provide a service protective fitting of appropriate rating for protection against short-circuits or earth faults on mains.	(2 marks)	ESR 32(1)	
(d) Any TWO of: ● Low voltage domestic installations with a maximum demand at or below 80A per phase if single-phase ● Low voltage domestic installations with a maximum demand at or below 50A per phase if multi-phase ● An installation or part installation intended for use with electrical medical devices. ● An installation or part installation in a hazardous area. ● A connectable installation or part of a connectable installation in a mobile electrical facility. ● A connectable installation or part of a connectable installation in a pleasure vessel. ● All other connectable installation or parts of connectable installation	(2 marks)	 ESR 59(1)(a) ESR 59(1)(b) ESR 60(1)(a) ESR 60(1)(b) ESR 60(1)(c) ESR 60(1)(d) ESR 60(1)(e)	

Question 1	*Marks*	*Reference*	*Marking notes*
● A site installation or part of a site installation that is in a marina		ESR 60(1)(f)(i)	
● A site installation or part of a site installation that is in a show or carnival.		ESR 60(1)(f)(ii)	
● A site installation or part of a site installation that is intended to supply connectable installations in mobile electrical facilities a show or carnival.		ESR 60(1)(f)(iii)	
● A site installation or part of a site installation that is intended to supply other connectable installations.		ESR 60(1)(f)(iv)	
(e) Any ONE of:	(2 marks)		
● The neutral shall be marked at switchboards to identify the associated active conductors in accordance with clause 2.9.5.5		AS/NZS 3000 2.2.1.2(c)	
● Where a common neutral is used for two or more different circuits it shall be legibly and permanently marked to identify the associated active conductors.		AS/NZS 3000 2.9.5.5	
(f) Any ONE of:	(2 marks)		
● Provided that the live parts are arranged so that basic protection is provided by barriers is accordance with the provisions of clause 1.5.4.4.		AS/NZS 3000: 2.9.3.1 Exception 1	
● Provided that the switchboard is installed in an area which is accessible only to authorized persons and the means of access to such areas is provided with facilities for locking.		AS/NZS 3000: 2.9.3.1 Exception 2	
(g) (i) Any ONE of:			
● Outside or not above any classified zone	(1 mark)	AS/NZS 3000 2.9.2.5.(e)	
● Outside any classified zone	(1 mark)	AS/NZS 3000 6.3.4.6	
(iii) Any ONE of:			
● It cannot be installed in the vicinity of a fire sprinkler.			
● Or Any ONE of:	(1 mark)	AS/NZS 3000 2.9.2.5(j)	

Question 1	*Marks*	*Reference*	*Marking notes*
* It must have a degree of protection of IPX4 * It is provided with a shield to prevent water spraying on it * Sprinkler heads that project water on the switchboard are provided with suitable deflectors * Sprinkler heads are of the dry type			
(h) Any TWO of: ● The low voltage cables are of a type providing the equivalent of double insulation; or ● All cables or each conductor of a multicore cable are insulated for the highest voltage present; or ● The low voltage cables are installed in a separate compartment of a common cable trunking system and the compartment has fixed and continuous barriers.	(2 marks)	AS/NZS 3000 3.9.8.3	
(i) ● Marker signs where the cable enters or leaves the building	(1 mark)	AS/NZS 3000 3.11.4.6(a)	
● Recorded on a plan that is located at the switchboard at which the cable originates.	(1 mark)	AS/NZS 3000 3.11.4.6(b)	
(j) Any ONE of:	(2 marks)		
● The main earth bar and the earth electrode.		AS/NZS 3000 Figure 5.1	
● Where the main earthing conductor connects the main earth terminal to an electrode.		AS/NZS 3000 5.3.3.2	
● An earthing conductor deemed to be the main earthing conductor shall be taken from the main earthing terminal/connection or bar at the main switchboard to an earth electrode.		AS/NZS 3000 5.5.1.1	

Question 2	*Marks*	*Reference*	*Marking notes*
(a) (i) • AS/NZS 3000.	(½ mark)	AS/NZS 3001 3.1	
• AS/NZS 3001. Section 3	(½ mark)	AS/NZS 3001 3.1	
(ii) A certificate of compliance	(1 mark)	ESR 65(1)	
(b) (i) For caravans the supply lead should be a minimum of 10 m.	(1 mark)	AS/NZS 3001 Appendix C6.8	
(ii) • Socket-outlets shall have effective continuity of all earthing conductors from the earth pin of the supply lead plug	(1 mark)	AS/NZS 3001 Appendix C7.5(a)	
• To the earth pin of each socket-outlet	(1 mark)	AS/NZS 3001 Appendix C7.5(a)	
(ii) • Any ONE of:	(1 mark)		
* The supply lead plug shall comply with IEC 60309 and have a rating of not less than 15 A.		AS/NZS 3001 Appendix C6.7	
* The supply lead plug shall comply with IEC 60309 and have a rating of not less than 16 A.		AS/NZS 3001 5.1.2(b)(iii)	
• Any ONE of:	(1 mark)		
* The supply lead plug shall comply with AS/NZS 3112 and have a rating of not less than 15 A.		AS/NZS 3001 Appendix C6.7	
* The supply lead plug shall comply with AS/NZS 3112 and have a rating of not less than 15 A.		AS/NZS 3001 5.1.2(b)(i)	
• If the plug complies with AS/NZS 3112 the connectable installation shall be protected by an RCD and shall have no neutral/earth link or connection.	(1 mark)	AS/NZS 3001 Appendix C6.7	
(iv) Any FOUR of:	(2 marks)		
• The warrant of electrical fitness must be issued in accordance with AS/NZS 3001.		ESR 78(2)	

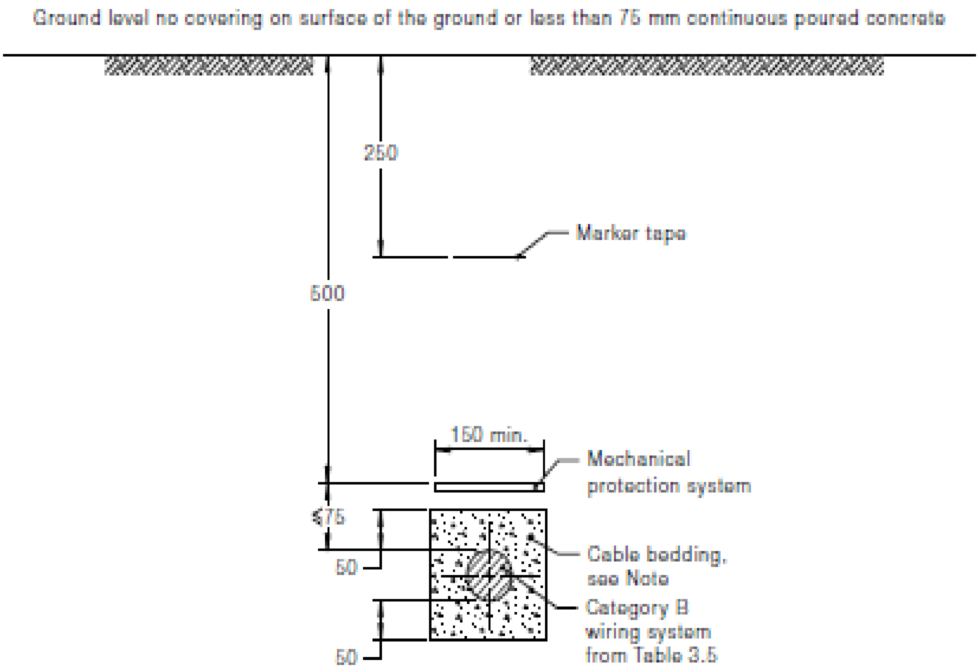
Question 2	*Marks*	*Reference*	*Marking notes*
- It must be given to the person who requests the warrant - A copy of the completed warrant must be kept for at least 3 years or a copy sent to WorkSafe. - A warrant of electrical fitness sticker must be completed that is in the form prescribed or approved by WorkSafe - The sticker must be affixed in a prominent place on the connectable installation.		ESR 78(3)(a) ESR 78(3)(b) ESR 78(3)(c) ESR 78(3)(d)	

Question 3	*Marks*	*Reference*	*Marking notes*
(a) Any TWO of:	(2 marks)		
• Installation not less than 1.8 m above the ground, floor or platform		AS/NZS 3000 4.5.1.1(i)	
• Provision of a suitable guard for the lamp and its lampholder.		AS/NZS 3000 4.5.1.1(ii)	
• The lampholder is incorporated in a luminaire.		AS/NZS 3000 4.5.1.1(iii)	
(b) Shall be connected to the supply so the neutral conductor is connected to the outer contact.	(1 mark)	AS/NZS 3000 4.5.1.2	
(c) (i) • To prevent excessive temperature rise of the luminaire and auxiliary equipment	(1 mark)	AS/NZS 3000 4.5.2.3.1(a)	
• To prevent the risk of fire from ignition of combustible materials.	(1 mark)	AS/NZS 3000 4.5.2.3.1(b)	
(ii) Any ONE of:	(2 marks)		
• The installation of a luminaire designed and certified by the manufacturer as being suitable for operation in contact with combustible materials.		AS/NZS 3000 4.5.2.3.1(i)(A)	
• The installation of a luminaire designed and certified by the manufacturer as being suitable for operation in contact with or enclosed/covered by thermal insulation material		AS/NZS 3000 4.5.2.3.1(i)(B)	
• The installation of a luminaire in combination with a barrier tested and classified in compliance with AS/NZS 5110 as being suitable for the installation conditions.		AS/NZS 3000 4.5.2.3.1(ii)	
• The installation of a luminaire with separation from thermal insulating materials, combustible building elements and loose combustible materials not less than the minimum clearance specified by the manufacturer of the		AS/NZS 3000 4.5.2.3.1(iii)(A)	

Question 3	*Marks*	*Reference*	*Marking notes*
luminaire, which may require a barrier or guard constructed of fire resistant materials; or			
• The installation of a luminaire with separation from thermal insulating materials, combustible building elements and loose combustible materials not less than the default clearances as specified in figure 4.7, which may require a barrier or guard constructed of fire resistant materials.		AS/NZS 3000 4.5.2.3.1(iii)(B)	
• Only recessed luminaires of Classes IC-F, IC, CA80 or CA 135, which are compliant with AS/NZS 60598.2.2, including NZ only amendment A, shall be installed in residential buildings)		AS/NZS 3000 4.5.2.3.4(a)	
• All classes of recessed luminaire shall be spaced from other building elements as given in the luminaire manufacturer's instructions.		AS/NZS 3000 4.5.2.3.4(c)	
• If no instructions are available, the default clearances shown in Figure 4.9 shall apply and a fixed guard constructed of rigid fire-resistant material may be required.		AS/NZS 3000 4.5.2.3.4(c)	

Question 3	*Marks*	*Reference*	*Marking notes*
• Clearances A 200 mm B 200 mm C 50 mm D 50 mm		AS/NZS 3000 Figure 4.7	
• Clearances HCB 100 mm SCB 100 mm SCI 100 mm SCG 50 mm		AS/NZS 3000 Figure 4.9	
(d) Any THREE of:	(3 marks)		
• Shall be as short as possible		AS/NZS 3000 4.3.5(a)	
• Have a current carrying capacity not less than the maximum load of the connect appliance or luminaire		AS/NZS 3000 4.3.5(b)	
• Be protected against short-circuit in accordance with clause 2.5.4		AS/NZS 3000 4.3.5(c)	
• Where earthing is required, be provided with a protective earthing conductor of suitable cross-sectional area that will ensure operation of the circuit protective device, in the event of a fault to earth, without damage to the protective earthing conductor.		AS/NZS 3000 4.3.5(d)	

Question 4	*Marks*	*Reference*	*Marking notes*
(a) • Category A system Where the wiring system is inherently suitable for installation below ground and no further mechanical protection is required.	(1 mark)	AS/NZS 3000: 3.11.2	
• Category B system Where the wiring system is suitable for installation below ground only with additional mechanical protection for the cable or cable enclosure.	(1 mark)	AS/NZS 3000: 3.11.2	
• Category C system Where the wring system is laid within a channel chased in the surface of rock.	(1 mark)	AS/NZS 3000: 3.11.2	

Question 4	Marks	Reference	Marking notes
(b) (i)  Ground level no covering on surface of the ground or less than 75 mm continuous poured concrete 250 Marker tape 500 150 min. Mechanical protection system ≤75 50 Cable bedding, see Note Category B wiring system from Table 3.5 50			A category A system can be used (figure 3.11) provided reference is made to column 2, 3, 4 or 5 of Table 3.5
• Correct depth of marker tape	(½ mark)	AS/NZS 3000: Figure 3.14	
• Correct depth of mechanical protection	(½ mark)	AS/NZS 3000: Figure 3.14	
• Correct width of mechanical protection	(½ mark)	AS/NZS 3000: Figure 3.14	
• Correct distance between mechanical protection and cable	(½ mark)	AS/NZS 3000: Figure 3.14	
• Correct depth of bedding above cable	(½ mark)	AS/NZS 3000: Figure 3.14	
• Correct depth of bedding below cable	(½ mark)	AS/NZS 3000: Figure 3.14	
• Completely correct installation	(1 mark)	AS/NZS 3000: 5..3.2.3(d)	

Question 4	*Marks*	*Reference*	*Marking notes*
(c) ● Any conductor span attached to a building. ● Any conductor span within arms reach of any building, building opening or structure. ● Above areas where sailing craft or irrigation pipes are used. ● In areas declared by the responsible Fire Authority as being subject to bushfires.	(½ mark) (½ mark) (½ mark) (½ mark)	AS/NZS 3000: 3.12.2.1(a) AS/NZS 3000: 3.12.2.1(b) AS/NZS 3000: 3.12.2.1(c) AS/NZS 3000: 3.12.2.1(d)	
(d) ● 7 strands ● 16mm^2	(½ mark) (½ mark)	AS/NZS 3000: 3.12.2.2(a) AS/NZS 3000: 3.12.2.2(a)	

Question 5	*Marks*	*Reference*	*Marking notes*
(a) ● Any ONE of:	(1 mark)		
* Protective devices providing protection against both overload and short-circuit current shall be capable of breaking any overcurrent up to and including the prospective short circuit current at the point where the device is installed.		AS/NZS 3000: 2.5.2	
* The breaking capacity shall be not less than the prospective short-circuit current at the point where the devices are installed.		AS/NZS 3000: 2.5.4.5(a)	
● All currents caused by a short circuit occurring at any point of a circuit shall be interrupted before the temperature of the conductors reaches the permissible limit.	(1 mark)	AS/NZS 3000: 2.5.4.5(b)	
● All currents caused by a short circuit occurring at any point of a circuit shall be interrupted before the temperature of the conductors reaches the permissible limit.		AS/NZS 3000: 2.5.4.5(b)	
(b) Any TWO of:	(2 marks)		
● Where unexpected opening of the circuit could cause a danger greater than overload.		AS/NZS 3000: 2.5.3.4(a)	
● Provided that the conductor is not situated in a location presenting a fire risk or a risk of explosion.		AS/NZS 3000: 2.5.3.4(b)	
● Provided that the conductor is not situated where requirements for special installations and locations specify different conditions and the conductor is located on the load side of a change in current-carrying capacity that is effectively protected against overload by a protective device placed on the supply side of the origin of the conductor.		AS/NZS 3000: 2.5.3.4(b)(i)	
● Provided that the conductor is not situated where requirements for special installations and locations		AS/NZS 3000: 2.5.3.4(b)(ii)	

Question 5	*Marks*	*Reference*	*Marking notes*
specify different conditions and the conductor supplies electrical equipment that is not capable of causing an overload current and the conductor has no branch circuits or socket outlets connected between the origin of the conductor and the electrical equipment.			
● Provided that the conductor is not situated where requirements for special installations and locations specify different conditions and the conductor is provided for installations for telecommunication, control, signalling, and the like.		AS/NZS 3000: 2.5.3.4(b)(iii)	
(c) Any TWO of:- ● Circuit-breakers incorporating short-circuit and overload releases. ● Fuse combination units (CFS units). ● Fuses having enclosed fuse links (HRC fuses). ● Circuit-breakers in conjunction with fuses.	(2 marks)	AS/NZS 3000: 2.5.2	
(d) Any TWO of: ● Enclosed fuse-links complying with the appropriate Standard(s) in the AS 60269 series. ● Miniature overcurrent circuit-breakers complying with AS/NZS 60898 or AS 3111 ● Moulded-case circuit-breakers complying with AS 60947.2. ● Fixed setting RCDs complying with AS 3190, AS/NZS 61008.1 or AS/NZS 61009.1.	(2 marks)	AS/NZS 3000 2.4.3	
(e) ● Any ONE of: * gM fuse links have a higher fusing factor. * gG fuse links have a utilisation category of 1.25 to 1.5, gM fuse links have a utilisation category of 1.6 to 2.5.	(1 mark)	GK	
● They will not operate under motor starting currents.	(1 mark)	GK	

Question 6	*Marks*	*Reference*	*Marking notes*
(a) Section 8 of AS/NZS 3000	(1 mark)	GK	
(b) (i) A certificate of compliance	(1 mark)	ESR 65(1)	
(ii) The person authorised to issue the certificate (that is, registered electrician).	(1 mark)	ESR 68	
(iii) Any ONE of:	(2 marks)		
● It is high risk prescribed electrical work		ESR 6A(2)	
● All high-risk prescribed electrical work is required to be inspected.		ESR 70(1)	
(iv) ● Work on mains (including connecting the conductors of mains at a MEN switchboard):	(1 mark)	ESR 4	
● Work on main earthing systems (including connecting the conductors of main earthing systems at a MEN switchboard):	(1 mark)	ESR 4	
● Work on the connection between earth and neutral made by the removable link within the MEN switchboard closest to the point of supply	(1 mark)	ESR 4	
(v) An electrical safety certificate.	(1 mark)	ESR 74A(1)	
(vi) To the person who contracted for the prescribed electrical work.	(1 mark)	ESR 74G(1)(a)	

Solution 1 – Food chiller in Load Group C

Equipment	**Load Group**	**Calculation**	**Load (A)**	
Fluorescent lights	A	15 x 40 x 0.75 = 450 450 ÷ 230 = 1.96	1.96	(1½ marks)
LED recessed lights	A	35 x 8 x 0.75 = 210 210 ÷ 230 = 0.91	0.91	(1½ marks)
10A Socket outlets	B(i)	1000 + (14 x 400) = 6600 6600 ÷ 230 = 28.7	28.7	(1½ marks)
15A socket outlets	B(iii)	15 + (4 x 15 x 0.5) = 45	45	(1 mark)
6 kW gas/electric range	C	6000 ÷ 230 = 26.1	26.1	(1 mark)
3 kW clothes dryer	C	3000 ÷ 230 x 0.5 = 6.52	6.52	(1 mark)
2kW food chiller	C	(2000 ÷ 230) x 0.5 = 4.34	4.34	(1 mark)
Total			**113.53**	**(1½ marks)**

AS/NZS 3000: Table C2 column 2

Solution 2 – Food chiller in Load Group D

Equipment	**Load Group**	**Calculation**	**Load (A)**	
Fluorescent lights	A	15 x 40 x 0.75 = 450 450 ÷ 230 = 1.96	1.96	(1½ marks)
LED recessed lights	A	35 x 8 x 0.75 = 210 210 ÷ 230 = 0.91	0.91	(1½ marks)
10A Socket outlets	B(i)	1000 + (14 x 400) = 6600 6600 ÷ 230 = 28.7	28.7	(1½ marks)
15A socket outlets	B(iii)	15 + (4 x 15 x 0.5) = 45	45	(1 mark)
6 kW gas/electric range	C	6000 ÷ 230 = 26.1	26.1	(1 mark)
3 kW clothes dryer	C	3000 ÷ 230 x 0.5 = 6.52	6.52	(1 mark)
2kW food chiller	D	(2000 ÷ 230) = 8.7	8.7	(1 mark)
Total			**117.89**	**(1½ marks)**

AS/NZS 3000: Table C2 column 2

Note: A Total in the range 112A to 120A is acceptable

Question 8	*Marks*	*Reference*	*Marking notes*
(a) Any THREE of:	(3 marks)		
• Consumers mains		AS/NZS 3000: 2.3.3.1 Exception (a)	
• Equipment installed as required by an electricity distributor for service protection, control or electricity consumption metering purposes		AS/NZS 3000: 2.3.3.1 Exception (b)	
• Ancillary equipment, measuring devices, and associated wiring …… provided that this wiring and equipment are confined within or on the switchboard.		AS/NZS 3000: 2.3.3.1 Exception (c)	
• Equipment ……… associated with a safety service that is connected on the supply side of a main switch		AS/NZS 3000: 2.3.3.1 Exception (d)	
• Equipment ……… associated with alternative supply system that is connected on the supply side of a main switch		AS/NZS 3000: 2.3.3.1 Exception (e)	
• Fault current limiters.		AS/NZS 3000: 2.3.3.1 Exception (f)	
• Surge diverters installed to protect consumers mains or main switchboards.		AS/NZS 3000: 2.3.3.1 Exception (g)	
(b) Any ONE of:	(2 marks)		
• Each main switch shall be marked "MAIN SWITCH" and shall be readily distinguishable from other switchgear by means of grouping, contrasting colour or other suitable means to provide for prompt operation in an emergency		AS/NZS 3000: 2.3.3.4(a)	
• Where there is more than one main switch, each main switch shall be marked to indicate the electrical installation for portion of the electrical installation it controls.		AS/NZS 3000: 2.3.3.4(b)	
• Where supply is provided at more than one point in any building, a prominent notice shall be provided at each main switchboard, indicating the presence of other supplies and the location of other main switchboards.		AS/NZS 3000: 2.3.3.4(d)	

Question 8	*Marks*	*Reference*	*Marking notes*
(c) Functional switching may be used where switching of electrical equipment or part of an electrical installation is required for operational control only and not for safety reasons. (2 marks)	(2 marks)	AS/NZS 3000: 2.3.7.1	
(d) • Consumers mains.	(1 mark)	AS/NZS 3000: 2.3.2.1.1(b)(A)	
• Where the neutral conductor is used as a combined protective earthing conductor and neutral (PEN) conductor for protective earthing of any portion of an electrical installation.	(1 mark)	AS/NZS 3000: 2.3.2.1.1(b)(B)	
(e) Any ONE of:	(1 mark)		
• It shall be located and identified in accordance with clauses 2.3.3.3, 2.3.3.4 and 2.9.2.4		AS/NZS 3000: 2.3.3.5(a)	
• It shall isolate supply to the associated parts of the installation.		AS/NZS 3000: 2.3.3.5(b)	
• It shall be provided with a suitable device to enable it to be locked in the open position.		AS/NZS 3000: 2.3.3.5(c)(ii)	

Question 9	*Marks*	*Reference*	*Marking notes*
(a) ● 5 seconds	(½ mark)		
● Any ONE of:	(½ mark)		
* AS/NZS 3000:1.5.5.3(d)(ii).			
* AS/NZS 3000: 5.7.2(b)			
* AS/NZS 3000: B4.3			
(b) (i) Current for one light			
$A = \frac{W}{V}$	(½ mark)		
$= \frac{100}{230}$	(½ mark)		
$= 0.435A$	(1 mark)		
Voltage drop of 1st light			
$Vd = \frac{mV/A.m \times A \times m}{1000}$	(½ mark)		
$= \frac{18.9 \times (2 \times 0.435) \times 100}{1000}$	(½ mark)		
$= 1.64V$	(1 mark)		
(ii) Voltage drop of 2nd light			
$Vd = \frac{mV/A.m \times A \times m}{1000}$			
$= \frac{18.9 \times 0.435 \times 20}{1000}$	(½ mark)		
$= 0.164V$	(½ mark)		
Vd total	(½ mark)		
$= 1.64 + 0.164$			
$= 1.804V$	(½ mark)		
(c) (i) Resistance of 1 cable core + screen from supply switchboard to second light	(½ mark)		
$R = \frac{7.41 \times (2 \times 120)}{1000}$	(½ mark)		
$= 1.78\Omega$	(1 mark)		
(ii) From Table 8.2, the maximum permitted fuse is 16A	(1 mark)		